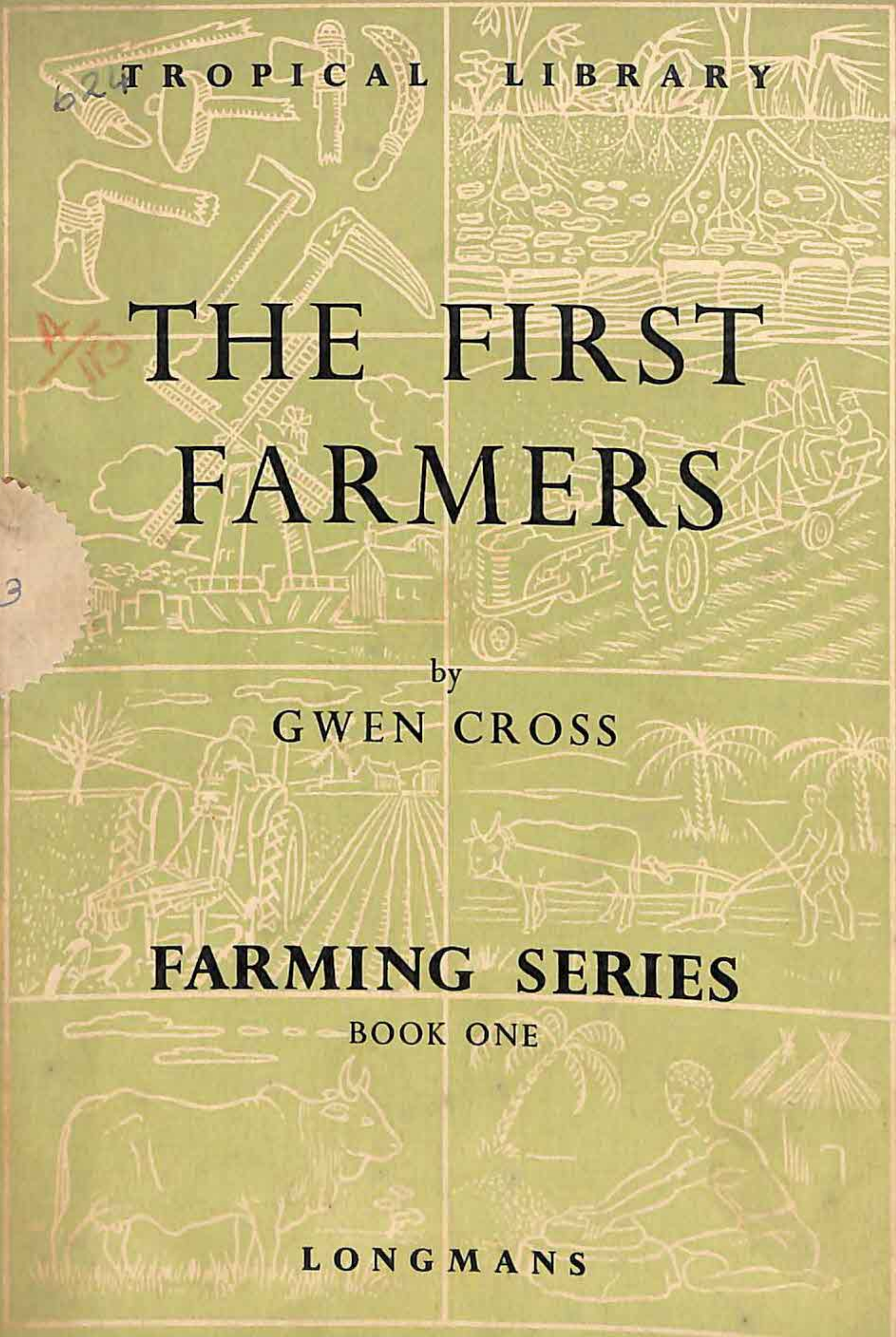

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by

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First published 1949
New impressions by photolithography 1955, 1958 and 1960

[illegible]
[illegible] 28.7.05
[illegible] 11674

Printed in Great Britain by
Lowe and Brydone (Printers) Limited, London, N.W.10

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PART 1. THE EARTH A HOME FOR MAN

CHAPTER 1

THE SOIL, GOD'S GOOD GIFT

"In the beginning God made the Heaven and the Earth."—Genesis i 1.

TO-DAY, millions of years after, we see many wonderful and beautiful things which God has made. Many of the things we see round us are living things. Other things have lived but are now dead. Still others have never lived.

We all know the names of many living creatures—birds, animals, insects, fish and plants—which we see every day. Some of them we use for food, while others, or parts of them, we use in many different ways.

Many of the things we use every day were once living in fields, gardens or forests in our own or in other countries. Our houses may be made from poles and leaves found in the forest. Our clothes may be made from cotton which grew in a far country. We write with a pencil on paper and, when we make a mistake, we use a rubber. The rubber, the paper and the wood of the pencil were made from parts of living trees. These are just a few of the things man has learned to make from plants that once lived.

Other things we use have not come from plants or animals. They come from things that have never lived. Nails, needles, hoes, knives, axe heads, iron tanks and roofs, tins and plates came from things found in the ground, perhaps deep down under the soil. Men have learned how to find and use the things which are hidden in the hard rock under the ground as well as those which live and grow on top of it.

In most places we find above the hard rock a layer of soft, dark soil. To us it does not look wonderful, but it was made in a wonderful way. If there was no soil, there would be no animals, insects or plants. We would not have any wood for our houses or cotton for our clothes, and we would have no rubbers, paper or pencils. We would not be able to live on earth at all. Without soil the earth would be bare and dead.

Plants, birds, insects, animals and man all need the soil. On it the plants grow and birds, insects, animals and men eat the plants. The soil is like a mother to all living creatures. So we must, for our own sakes, take care of the soil, which has taken millions of years to make. In a few years man can so harm it that it is useless.[1] The soil is one of God's best gifts to man.

QUESTIONS

1. Write down all the new words in this chapter. Learn them.

2. Divide a page of your writing book into three parts. At the top of the parts write:

Living things	Things that once lived	Things that have never lived

In each part write the names of five things about which the words at the top are true.

---

[1] Useless: of no use.

3. Write the names of three birds, three insects, three animals, three plants, which you know. (Write the names in your own language if you do not know them in English.)

4. Write the names of five things which come from the forest, the garden or the sea and which you can eat.

5. Which of these come from things that once lived: paper, sand, an axe head, an axe handle, rubber, a cup, flour, a tin, a shirt, sugar, a blanket, a nail?

6. Complete these sentences:

The soil is like a . . .
Without soil the earth . . .
In a few years man can so harm the soil . . .
The soil is one of . . .

Now learn them.

CHAPTER 2

HOW THE SOIL WAS MADE. THE BEGINNING

GOD made the Earth millions of years ago. At first it was a ball of fire. It cooled and the outside became hard, bare rock. There was no soil on the mountains, the hills or the plains. There were no plants, animals, birds, insects or men. Nothing lived on the earth. There were only rivers, lakes, seas and bare rocks.

For millions of years wind and water, ice and snow, cold and heat have been changing the hard, bare rocks. They have broken the rock into big stones, the big stones into little stones, the little stones into gravel[1] and the gravel into soil. They have carried these pieces of broken rock from one place to another. They have been doing this all the time, but they have worked very slowly. They are working now, breaking, rubbing, carrying rocks and stones and soil from place to place. This work is called erosion.[1] Erosion of the rocks has helped to make our soil.

---

[1] Gravel: small pieces of rock.

QUESTIONS

1. Write down all the new words in this chapter. Learn them.
2. Name five things which have changed the hard rocks.
3. What is the hard rock broken up into before it becomes soil?
4. What is erosion?
5. Write down the past tense of:
   become live make

CHAPTER 3

HOW THE SOIL WAS MADE. LIVING THINGS APPEARED ON THE EARTH

IN good soil there is more than just broken rock. Many plants could not grow on soil that is only broken rock. If we look at the top-soil in the garden, we shall see in it many little pieces of dead roots, leaves and stems. These are the parts of plants which have lived and died on the soil. Now they are rotting away.

Long ago the first plants appeared on the earth. They were very little plants. They were rather like the flat green plants we sometimes see on rocks and tree trunks. They had very short roots. A juice from these roots helped to dissolve[2] the hard rock. In this way little paths were made in the rocks, and the roots were able to go still deeper. Juice from these deeper roots helped to dissolve more rock. The rock began to break up into smaller and

[1] Erosion: being eaten or worn away.

[2] Dissolve: make or become liquid.

smaller pieces, until coarse grains appeared. Erosion was also going on and helping to break up the rocks and stones.

When the first plants died, their bodies rotted in the coarse soil. Then little plants called mosses began to grow. They had longer roots than the first plants. Their roots helped to break up still more the coarse grains and rocks. The plants died and rotted. Very very slowly the rotted plants and coarse grains of rock made a thin layer[1] of soil on top of the rock.

Then grass and bushes and trees began to grow. The roots of these plants were longer still. They went down deeper into the rocks. They helped to break more rock and to turn the coarse grains in the soil into fine grains. When these plants died they rotted and helped to make more soil.

So it went on for many many years. The roots, stems, leaves, flowers and fruits of the plants died and rotted on the ground. Slowly the layer of fine grains of rock and rotted plants became deeper.

The soil in which plants grow is fine grains of rock mixed with pieces of rotted plants. These pieces of rotted plants we call humus. In millions of years many dead plants have rotted in the soil.

The layer of soil is never very deep. In some places it is a few feet deep; in others it is only a few inches deep. It is this layer of fine soil which feeds the plants growing on it.

QUESTIONS

1. Write down the new words in the chapter and learn them.
2. Copy from paragraph 2 the sentences which tell how the roots helped to break the hard rock.
3. What is humus?
4. What do we find in the soil in which plants grow.

---

[1] Layer: a thin covering.

CHAPTER 4

THE EARTH A HOME FOR MAN

AFTER the plants came the animals. The animals got their food from the plants and the trees. They moved about from place to place. Their waste food fell on the soil and rotted. When the animals died, their bodies also rotted on the soil.

Last of all came man. The Earth was now ready for him. There were plants, birds, animals and fish for him to eat. He could make houses from trees, and clothes from animal skins and parts of plants. So God made man.

In the first chapter of the Bible we can read how God made the Earth and prepared it so that it could be a home for man. It is a wonderful story.

QUESTIONS

1. Write down the new words in this chapter and learn them.
2. How did animals help to make the soil?
3. When man was made, what was ready on Earth for:
   (*a*) his food? (*b*) his houses? (*c*) his clothes?
4. Read the story of the Creation,[1] Genesis i and ii 1–7. Take the word "day" to mean "a long time."

---

[1] Creation: making a thing that has never been made before.

PART 2: MEN WHO LIVED LONG AGO

CHAPTER 5

THE MEN WHO HUNTED FOR THEIR FOOD

IN some parts of the Earth we have found the bones of men who lived many thousand years ago. Some of these bones have been found in the valleys of old rivers. The first men we know about are sometimes called River Men.

These River Men did not live in villages. They did not make gardens. They ate the nuts and fruits, the wild honey and roots which they found in the forests and near the rivers. Like the animals they moved from place to place looking for their food. They did not yet know how to cook their food and they ate flesh and other food raw. They killed the animals with sharp stones which they found near the rivers. They made the stones sharp by striking them together.

There are still people in Africa and Australia who live like these men of long ago. They have no villages and they go from place to place to find food. They are hunters. They eat the animals they kill and the nuts and fruits they find. Sometimes they have enough food. Sometimes they do not have enough and are hungry.

QUESTIONS

1. Write down the new words in this chapter and learn them.
2. What are the first men we know about sometimes called?
3. What food did these men eat?
4. With what did they kill the animals which they hunted?
5. How did they make their stones sharp?
6. In what countries are there still people who find their food by hunting?

7. Write down the past tense of: find, live, eat, move, kill.

8. Which of these foods are eaten raw: fish, oranges, potatoes, mangoes, maize?

CHAPTER 6

THE MEN WHO STORED FOOD

THEN there came a very cold time on Earth. Much of the land was covered with ice and snow. Many plants, animals and men died. Some men tried to find warmer countries while others tried to go on living in the cold places. They ate fish and shell-fish, and lived in holes in the ground. These holes are called caves, and the men who lived in them are called the Cave Men.

After many years the Earth became warm again. Plants grew again and bush and forest appeared once more. Men again hunted animals and looked for nuts, fruits, honey and roots, which they found in the bush. They saw that some nuts and fruits kept good for a long time. They found that by storing them they could have at least some food in the winter months, when it was difficult to find food in the bush. So men began to collect and store foods of this kind.

QUESTIONS

1. Write down all the new words in this chapter and learn them.

2. What did men eat when the plants and animals died in the cold?

3. Where did these men live? What are they called?

4. What did men do with some of the foods that kept good a long time?

5. What foods can you store a long time?

CHAPTER 7

THE MEN WHO PLANTED FOOD

LATER men began to plant food. I think that perhaps it happened like this. One day a woman collected some fruits from the bush for her food. She ate some and the rest she carried to the hole where she stored food. Some of the seeds fell on the soil near her store. The seeds grew into plants and they had fruit. The woman knew where to find this fruit and did not have to go and look for it.

The next time the woman collected fruits, she planted some of the seeds near her hut. The seeds grew into plants and the woman could get fruit without going to look for it. Some people laughed at her, but others did not laugh. They saw that this was a good thing to do and they did the same. They planted seeds near their huts and got the fruit without having to look for it. They saw that the plants grew better because there were not so many other plants round them. So they made little clearings[1] and planted other things from the bush. They made the first gardens. Agriculture had begun. Agriculture is a word which comes from Latin, and it means making things grow in a field.

It is thought that the first people to plant food lived in North Africa near the River Nile, and in West Asia near two rivers called the Tigris and the Euphrates. At a time when Europe was still very cold, it was warm in these places. In Egypt, through which the River Nile flows, and in Iraq, through which the Tigris and the Euphrates flow, barley grows wild. And it is thought that barley was the first plant that people grew in their gardens. Later they grew wheat and corn also. In Egypt men have found grains of wheat in the graves of people who died 6,000 years ago.

---

[1] Clearing: a piece of land cleared of trees and bushes.

QUESTIONS

1. Write down the new words in this chapter and learn them.
2. What does the word agriculture mean? From what language did it come to us?
3. In which countries is it thought the first gardens were made? Find the countries on the map. What is the name of the river which flows through Egypt?
4. What is the name of the first plant which we think men grew?
5. Where have men found grains of wheat thousands of years old?

CHAPTER 8

THE MEN WHO MADE THE FIRST TOOLS

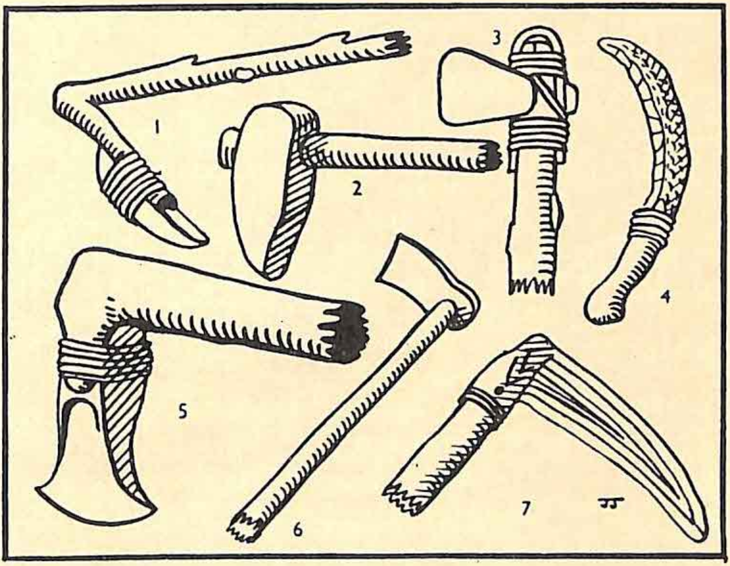
WHEN men began to make gardens, they had to clear places in the bush. They had to dig holes in which to plant the seeds. At first they burnt the trees and made holes with big sticks. In a few parts of the world, people still clear and dig their gardens like this. Like the people of long ago they have no hoes, spades or other tools made of iron.

But men wanted a quicker and better way of digging the soil. They wanted tools, and then they learned how to make them. They made a big hole in their flint[1] stones. They did this by rubbing one stone on another. Of course, this took a very long time. Then a strong stick was put through the hole. This was the first hoe.

[1] Flint: a very hard stone.

The hoe is the first tool that men used in their gardens. They found that digging made the flint heads sharper, so they began rubbing the edge with other stones to make them very sharp. This was the beginning of grinding tools to make them sharp. Before this men had sharpened their flint stones by hitting one against another.

Then men found that they could cut down trees with their sharp hoes. Thus they came to make the first axes. We know that in Egypt long long ago men used both hoes and axes.

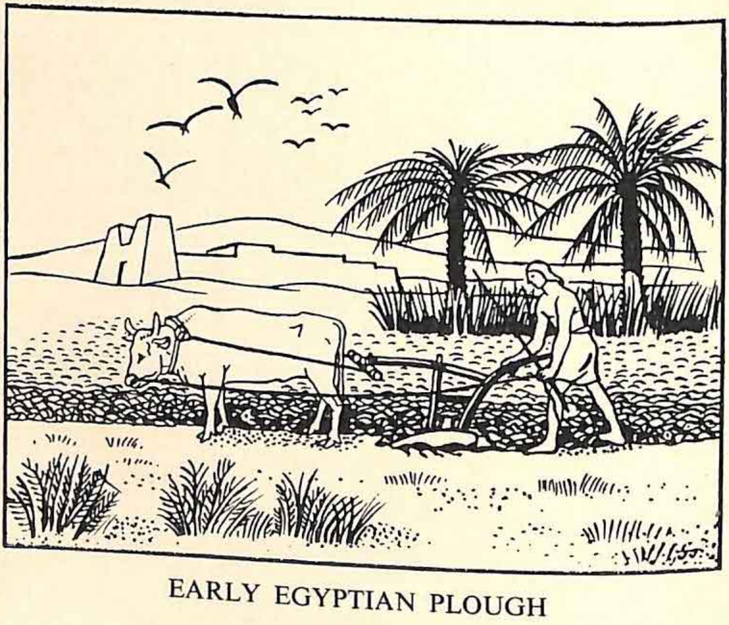


TOOLS OF LONG AGO

1 Hoe 2 Hoe 3 Axe 4 Sickle	Stone
5 Axe 6 Hoe 7 Sickle	Iron

In some places the people went on digging the soil with heavy sticks. They found that if they pulled the strong heavy stick along the ground it made a long line in the soil. This long line is called a furrow. It was quicker and easier to make a furrow than to make a number of little holes. This was the first plough. We can see pictures of these early ploughs in old graves and on old stones in Egypt. So men began to plant their seeds in the furrows made by ploughs. After planting the seeds they covered them with soil, which they then pressed down.

Then men began to tame animals. They tamed cattle and taught the oxen to pull ploughs. The oxen could pull heavier ploughs than a man could. The heavier plough made a deeper furrow, in which the seeds of bigger plants could be put.



EARLY EGYPTIAN PLOUGH

TRACTOR PULLING A PLOUGH

Still later men learned how to get iron from the ground, and how to make iron hoes and axes. They put iron on the end of the heavy plough stick, so that the plough did not wear away so quickly. As time went on men made better and better tools, but for thousands of years the plough was pulled by animals. It is only a few years ago that men began to use machines called tractors to pull their ploughs. They now use many wonderful machines to clear places for their fields and gardens and to cultivate them.

QUESTIONS

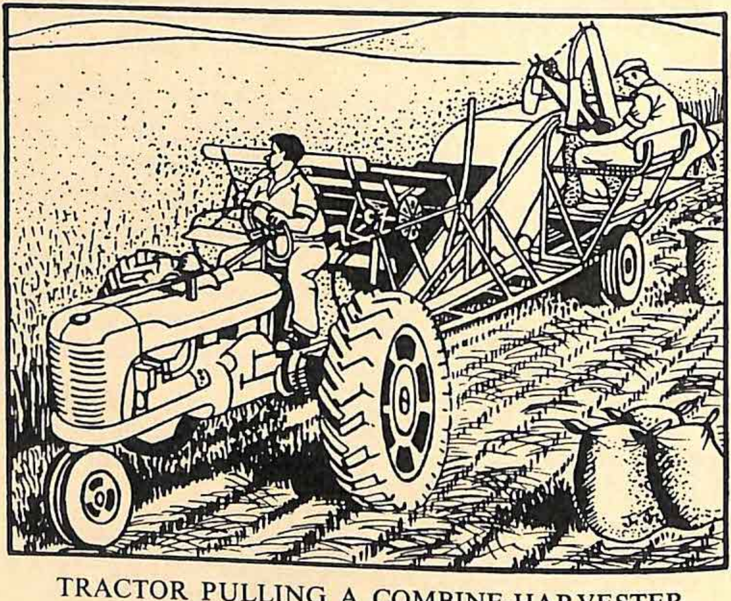
1. Write down the new words in this chapter and learn them.
2. What was the first tool men made?
3. How was the first plough made?
4. What were the first axes made of?
5. What tools do you use in your garden?
6. Find out the opposite of: sharp, heavy, big, deep, long. Learn them.

CHAPTER 9

HOW MEN HARVESTED THEIR CROPS

WHEN men first planted food they had no knives such as we have. When the grain was ripe they pulled up the stalks with their hands. In some countries the people still gather in corn like this. When men learned how to use iron they made knives and sickles.

After it was gathered in, the dry corn was put on a clean mud floor. Oxen walked round and round over it, and the grain fell out of the ear. This is called threshing the corn. We read in the Bible about threshing corn and wheat.



TRACTOR PULLING A COMBINE-HARVESTER

After threshing the grain was separated from the husks[1] and broken stalks, which are called chaff. The grain and chaff were thrown into the air; the wind blew away the chaff and the heavy grain fell to the ground. This separating of the grain from the chaff was called winnowing. We are told about winnowing in many places in the Bible, and we know that for thousands of years the peoples of the East have threshed and winnowed the grain. In parts of Asia and Africa village people still cut the grain with knives and sickles and still thresh and winnow like the people of long ago. In some countries wonderful machines are used. These machines, called combine-harvesters, do all this work and even put the grain in bags.

QUESTIONS

1. Write down and learn all the new words in this chapter.
2. What is threshing? How is it done in parts of Asia?
4. What is winnowing? You are told in this chapter of one way of doing it. Do you know of any other way?
5. Read St. Matthew iii 11, 12.

CHAPTER 10

HOW MEN MADE THE FIRST POTS

WOMEN stored the clean winnowed wheat and corn in baskets. Rats ate through the baskets to get the grain. Then the women covered the inside of the baskets with wet clay. They also made little baskets for lids and covered them with wet clay. The rats could not eat through the clay, which became hard when it dried. These were the first pots and in them the grain was kept safe and dry.

Then the women found that they could make pots without the baskets. They shaped the clay with their hands and, when it dried, it kept the shape they had given it. Sometimes the clay cracked when it was drying, so the women mixed sand with the clay. When this mixture was drying it did not crack. In these pots they could keep either grain or water.

---

[1] Husk: the dry outer covering of a grain.

In India, Africa and New Guinea pots are still made with red clay. In some countries white clay is used; this is called china clay. Cups, saucers and plates are made with china clay and have been given the name "china." Pots made with red clay are often called "earthenware" pots, that is, pots made with earth. Some earthenware pots have very small holes in them, and when water is put in them it runs slowly out through the holes. We say that pots of this kind are porous.[1]

QUESTIONS

1. Write down and learn all the new words in this chapter.
2. How did women make the first pots?
3. What are china cups made from?
4. What are earthenware pots made from?
5. What kind of pots are made in your country?

CHAPTER 11

HOW MEN FIRST GROUND CORN

MEN found that cooked corn was better to eat than uncooked corn. Then they found that, if they broke the corn before cooking it, it was better still. So they learned to put the corn in a wooden dish and to break it with a stick. In this way they made a coarse flour.

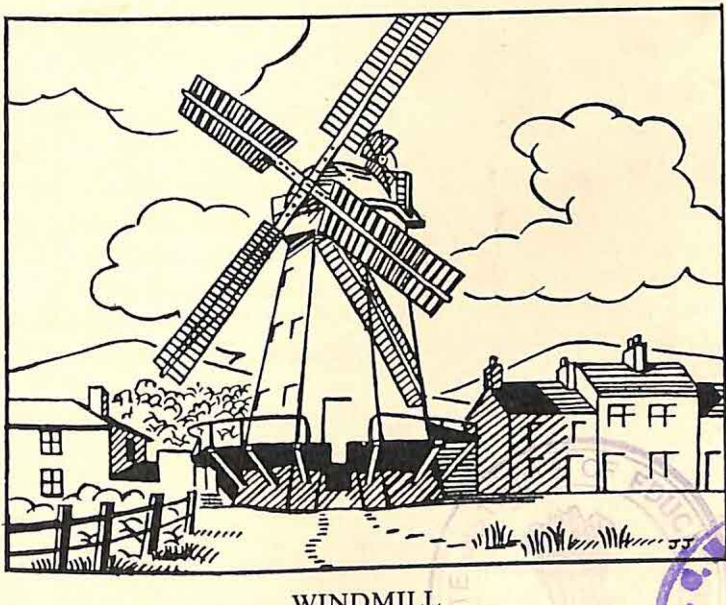
---

[1] Porous: full of very small holes.

They also learned to make a finer flour by putting the corn on a big stone and rubbing it with a smaller stone. Then they made two big flat stones and put one on top of the other. The top stone was turned and the corn or wheat was crushed between the two. This was a still better way of making flour. We call it "grinding" the corn, and the stones are called "millstones."

People in Palestine have ground corn in this way for thousands of years. The Lord Jesus saw his mother grinding corn between two stones when they lived in Nazareth, and in St. Luke xvii he speaks of two women grinding corn together. Very much earlier Samson ground corn in his prison in Gaza (Judges xvi 21).

Later men learned how to use the wind to turn the millstones. They built tall houses and on top of them they



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put large wooden sails. The wind turned the sails and the sails turned the stones. Now the millstones are turned by machines.

QUESTIONS

1. Write down all the new words in this chapter and learn them.
2. What is the present tense of these verbs: ground, broke, turned, built?
3. In your country what do the women make from flour?
4. What is the opposite of: coarse, tall?
5. What work is done by millstones?
6. How did the women of Palestine grind corn in the days of the Lord Jesus?

CHAPTER 12

VILLAGE LIFE

YOU have read how men made hoes, axes, ploughs, knives, pots and handmills. They worked in their fields and gardens, and they made better houses of trees, stones or mud. They learned to weave grasses, animal hair or seed hairs and to make clothes. So they did not have to move about looking for food and hunting animals. They began to stay for a long time in one place.

Several families built good houses near together, and villages grew up. Sometimes they made fences or stone walls round the villages to protect them from wild animals or from enemies.

People began to tame more animals. They had dogs to help them to hunt, cats to kill the rats, goats and cows to give them meat and milk, horses and oxen to pull carts and ploughs. Every year they planted more food near their villages and so they needed less of the wild things from the bush. A man who had more corn than he could use himself gave some of it to a man who had more milk than he needed. In this way men began to trade with one another. They no longer lived alone, hunting for their food as the wild animals do. They lived near each other, for they found that by doing so they could help one another. It took men thousands of years to find out all these things, and they did not all find them out at the same time. But here and there people became civilized and others learned from them.

QUESTIONS

1. Write down all the new words in this chapter and learn them.

2. Name two tame animals kept in your village. Name three different tame animals found in other countries.

3. Name two wild animals found in your country, and three found in other countries.

4. Why do African villages often have high fences round them?

5. In what countries do men make houses with trees? Do you know a country where houses are made with mud?

6. Do you know anything that is woven from (*a*) animal hair and (*b*) hair from seeds?

7. What does the word "civilized" mean?

8. Write these words in the plural[1]: knife, thief, family, axe, grass.

---

[1] Plural: the form of a word showing more than one.

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CHAPTER 13

OLD AND NEW WAYS

THERE are now millions of villages in the world. Millions of men and women work in fields and gardens, weave clothes, make pots, grind corn, build houses. For thousands of years men have been learning to do these things in better and better ways.

Sometimes a man tried to do something in a new way. Some people laughed at him, but others saw that the new way was good. They did not laugh, but copied him and tried the new way. So men have learned to do old things in new, quicker and better ways. In trying new ways they have also learned to do new things.

In these books we shall read about many things which are new to us. Are we like the foolish people who laughed at new ways? Shall we say like them, "This is of no use to us"? Or shall we try the new ways and see how they can help us? Shall we try to help our people to do old things in better ways? Are we wise enough to do in our homes and villages some of the good things which people of other countries have learned to do?

QUESTIONS

1. These words have been used in Parts 1 and 2 of this book. You will see them again in the other books about the soil. Learn them so that you will know what they mean:

layer erosion waste harm humus
fine coarse rot porous furrow
chaff grain clearing dissolve civilized
agriculture thresh winnow harvest grind

2. Complete these sentences, using in each, one word from the first line of words in question 1:

(*a*) The rotted plants and coarse grains of rock make a thin . . . of soil over the hard rock.
(*b*) Rotted plants are called . . .
(*c*) . . . of the rocks helped to make our soil.
(*d*) The . . . food of the animals rotted on the soil.

3. Complete these sentences, using in each one of the words from question 1:

(*a*) The stones . . . the flour fine.
(*b*) The plough sticks make long . . . in the soil.
(*c*) Sometimes earthenware pots are . . ., and water runs slowly out of them.
(*d*) The dead plants . . . on the soil.

4. Complete these sentences, using in each one of the words from question 1:

(*a*) Many things helped to break up the rock into coarse . . .
(*b*) The chaff is blown away by the wind and the . . . falls to the ground.
(*c*) . . . means making things grow in a field.
(*d*) The juices from the roots of plants helped to . . . the rock.

PART 3. THE SOIL

CHAPTER 14

THE SOIL, FOOD AND MAN

GOD made our bodies. He has given each part of our bodies work to do. 1 Corinthians xii 21.

God made the plants. He has given each part of a plant work to do. The roots drink. The leaves make food. The flowers make fruits and seeds.

If we want to be strong and well we must eat good food. Many of the things we eat are parts of plants. Others are parts of animals which also eat plants. So the plants must be strong and only good soil will give good food. We cannot get good food from poor soil. In order to get good food we should learn:

1. What soil is.
2. What foods the plants need.
3. Where plants get their food.
4. How to make poor soil better.
5. How to keep good soil good.

The things we use—clothes, knives, bicycles—get old and worn-out when we use them for a long time. The soil is different from these things which men make. God's soil will never get old and worn-out if we learn how to take care of it. There are fields in Europe and in China and Japan where men have been growing food for more than two thousand years. There are fields in America and Australia where men have been growing food for only one hundred years, and where the soil is now poor, because men did not know how to take care of it.

QUESTIONS

1. Write down the new words in this lesson. Learn them.

2. Name ten parts of your body. What work does each of these parts do?

3. Name three parts which you cannot see—a part with which you breathe, a part with which you swallow, and a part in which your blood is carried.

4. Name three parts of a plant. What work does each of these parts do?

5. Name a country where men have cared for the soil so that it has given them food for thousands of years.

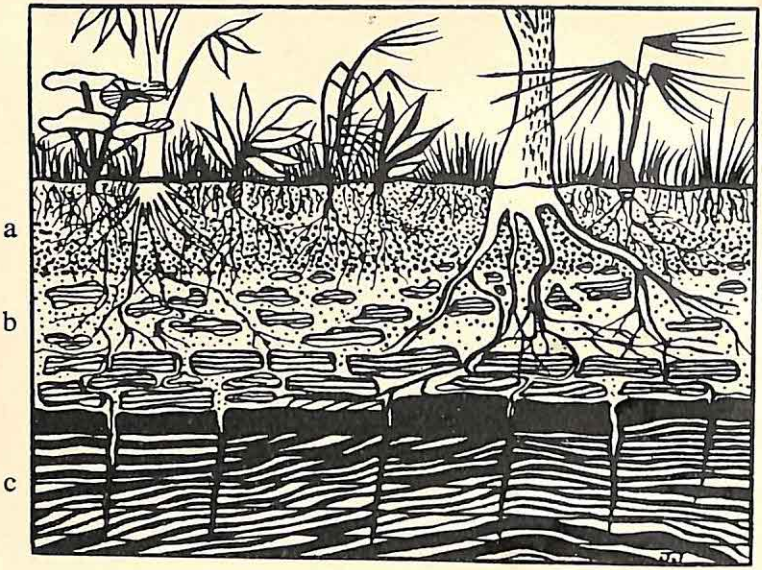
6. Why is the soil not good now in some parts of Australia and America, though it has been farmed for only a hundred years?

CHAPTER 15

LAYERS OF SOIL AND ROCK

IN the side of a deep hole in the ground we can sometimes see three layers: top-soil, sub-soil and rock. These layers are different in different places. If we dig deep enough we shall come to rock. Sometimes this rock is very hard, and sometimes it is black, grey, red or white in colour.

Above the rock there is the sub-soil. "Sub" means under, and so the layers of soil under the top-soil are called the sub-soil. Sometimes it is very deep. At the bottom of the sub-soil, near the rock, there are often big stones. Above the big stones there may be smaller stones, and above these still smaller stones, with coarse soil between them. The top part of the sub-soil is often fine soil with a few stones in it, and it is often lighter in colour than the top-soil. If it has much chalk in it, it may be nearly white.



LAYERS OF SOIL AND ROCK

a. Top-soil b. Sub-soil c. Rock

The long roots of trees grow down through the sub-soil until they reach the rock. In the sub-soil we do not find rotting parts of stems, leaves and fruits.

On top of the sub-soil is the layer of top-soil. This is darker than the sub-soil, because in it there are many rotting parts of plants and animals. The best top-soil is fine, and has few stones in it. In some places it is only a few inches deep; in other places it is several feet deep. But it is nowhere very deep.

The top two or three inches of top-soil are often black and full of rotting parts of plants, together with their living roots. The soil has taken millions of years to make, and the top-soil is the most important part of it. We shall read much about it in these books. Man cannot make it.

But if men do not look after it, heavy rains can carry tons of it away in a few hours.

THINGS TO DO

1. Look at the side of a deep hole or of a cliff and see the layers: top-soil, sub-soil and rock. Draw a picture of the layers.
2. Take a handful of top-soil. Look for pieces of dead plants in it. Put some soil in water and stir it. You will see little pieces of dead plants float on top of the water.
3. In the side of a hole or a cliff look for roots which have grown down into the sub-soil. In which layer of soil do you see most roots?
4. If you can go to holes or cliffs in different places, look at the different kinds and colours of the rock, sub-soil and top-soil.

QUESTIONS

1. Write down the new words in this lesson and learn them.
2. Name the three layers that can be seen in holes which are deep enough.
3. What does "sub" mean? What is the colour of the sub-soil in the place where you live?
4. What is the colour of the top-soil? Is it a few inches or a few feet deep?
5. Why is top-soil often darker than sub-soil?

CHAPTER 16

DIFFERENT KINDS OF SOIL

THERE are many different kinds of soil. In one place the top-soil may be red, and when it is wet it may be slippery[1] to walk on. When we dig it, perhaps it sticks to the tools.

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[1] Slippery: causing the foot to slip.

In another place the soil may be black. Some black soils are slippery when they are wet, others are not. The second kind does not stick to the boots when we dig it. In other places the top-soil is nearly white and it feels dry and coarse. On some of these soils plants grow well and give us good foods, but on other soils they do not do so.

There are many different kinds of rock. One kind of soil is largely made up of little pieces of one kind of rock, or sometimes of several kinds of rock. Very small pieces of rock are called particles (little parts). The size of these particles, the kind of rock they are made of and their nearness to each other help to make soils different from one another.

THINGS TO DO

Collect a little of two or three different kinds of soil and some sand (sea-shore sand if you live near the sea). Dry them in the sun. Put each kind of soil and the sand on a piece of white paper, spreading it thinly. Look at the particles of each of them, then look at them again with a lens[1] if you have one.

Answer these questions about each soil and the sand:

1. What is the colour of the particles?
2. What is their shape? (Round, long, etc.)
3. Can you see each particle without using a lens? (If you can do this, the particles are big ones.)
4. Are all the particles big, or are some of them smaller than others?
5. Are the particles soft or hard? Can you break them?
6. When you wet the particles are they sticky?
7. If you put the soils in tins which have small holes in the bottom, does water flow quickly through the soils?

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[1] Lens: a glass that makes small things look bigger.

QUESTIONS

1. Write down the new words in this lesson and learn them.
2. What is it that helps to make soils different from one another?
3. Which did the water pass through most quickly, one of the soils or the sand?

CHAPTER 17

ABOUT DIFFERENT SOILS

WHEN we look at particles of different soils, we see that they are of different sizes. A soil with big particles like small stones is called a Gravel. A soil with particles which are small, but which we can see without a lens, is called a Sandy Soil. A soil with very small particles, which we can see only through a lens, is called a Clay Soil.

Gravel soil

Gravel is made up of little pieces of rock like small stones. We can see the pieces clearly without a lens. They are hard and do not dissolve in water. Water flows quickly through this kind of soil, and most plants do not grow well on it.

Sandy soil

Sandy soil is made up of little particles of rock. It feels coarse to our fingers. We can see the particles without a lens. They are hard, and we cannot break them with a pin. They are of different shapes, sizes and colours. They may be black, red, yellow, brown, white or transparent.[1]

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[1] Transparent: can be seen through.

They do not stick together; each particle is separate from the others, and there are wide spaces between them. In these spaces there is air. Water flows quickly through sandy soil, and it does not dissolve the particles. Sandy soil gets hot quickly. We all know how hot a sandy path feels to our feet in the midday sun, and how the dust rises as we walk along. Sandy soil is light, hot and dry. It is a thirsty soil. Few plants can grow on sea-shore sand because it is so hot and there is so much salt in it.

Clay soil

Clay soil is made up of very very small particles of rock. The particles are soft and they do not feel coarse between the fingers. We can see them only with a lens. They are close to each other, so there is not much air between them. When they get wet they become sticky. Water flows slowly through clay soil, so we say that it holds water. It is a heavy, wet, cold soil. But when it is dry it becomes hard and cracks appear in it.

Many soils are mixtures[1] of these three soils. They have different amounts of each in them. Plants do not grow well in a soil that is all gravel, or all sand, or all clay. Plants like mixtures of these soils.

THINGS TO DO

Separate the different kinds of soil in a top-soil by doing this. Put an inch of the top-soil in a glass jar, and pour water on it. Stir the soil in the water and then let the jar stand for a time. The soil will begin to sink to the bottom. First the little stones will sink—this is the gravel part of the soil. Then the little particles of sandy soil will sink on top of the gravel.

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[1] Mixture: something formed by putting two or more different things together.

You will see that the water above the sandy soil is brown. If we let the jar stand a long time, all night perhaps, very very small particles of soil will sink on top of the sandy layer. Next morning the water will be almost clear, because in the night the very fine clay particles have sunk. In the jar there will be three layers—a gravel layer of little stones, a sandy layer of small particles and a clay layer of very small particles. Floating on the top of the water there will be little pieces of the dead roots, stems and leaves of plants.

QUESTIONS

1. Write down the new words in this lesson and learn them.
2. Name the three kinds of soil you have read about in this lesson.
3. Which soil has more air in it, sandy soil or clay soil? Which of them is a dry soil?
4. Which soil has the smaller particles, sandy soil or clay soil? Which of them is a cold, wet soil?
5. If you stir a little soil in water, which part of the soil will sink first? second? third? What will float on top of the water?

CHAPTER 18

ABOUT DIFFERENT SOILS

Humus soils

WHEN we stir top-soil in water and let the mixture stand, the particles of rock and stone sink. Pieces of dead roots, stems and leaves are left floating on top of the water.

When plants and animals die their bodies fall on the soil. Little living things in the soil and in the air feed on these dead bodies and on the dung of animals. These very little living things are called microbes or bacteria. Some of them are the farmer's friends. When the microbes feed on dead plants they change them, and we say that the plants rot. These rotting plants put back into the soil some of the things they took from it. We say that they have become humus.

These are some of the things we know about humus:

1. Humus is black and soft, and it is often the humus that gives the top-soil its dark colour.
2. Humus weighs very light.
3. There is always air among the small pieces of humus.
4. Humus does not dissolve in water, though some of the plant foods, into which it is changed by the microbes, do dissolve in water.
5. Humus holds water a long time, and the plant foods dissolve in the water.
6. Humus helps to keep the soil warm. Things that are dark in colour are warmer than things that are light in colour. When things rot, heat is given off.
7. Humus makes sandy soils hold together. It makes clay soils less heavy. We say that humus gives these soils a better *texture.*[1]
8. Humus is a home for bacteria in the soil.
9. Humus is made slowly as the plants rot, and so all the time food is being made in the soil for other plants. A rotting plant helps the soil for several years.
10. Humus is not itself a plant food, but it helps to make plant foods.

We see much humus under the trees in the forest. Leaves, flowers, fruits and dead branches have fallen on the soil for very many years. The soil in the forest is black and soft and damp. Every year more dead parts of plants fall, and every year the soil in the forest becomes better.

The humus is found in the top-soil, which may be poor in humus, good in humus or rich in humus. If more than a quarter of the top-soil is humus, plants do not grow well on it. Soils which are nearly all humus are called peat. In some countries, like Ireland, there is much peat. People dig it, dry it and burn it in their fires. Peat soil is often very wet because the water cannot run away. This water helps to make the peat.

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[1] Texture: the way a thing is made up.

Lime soils

Many soils have some lime in them. There is lime in shells, coral and chalk. A soil which has much lime in it is nearly white, and it feels coarse to the fingers. Like humus, lime helps the texture of the soil. It makes sandy soil hold together and makes heavy clay soil lighter. It makes sour soils better. If a soil has too much lime in it, some plants will not grow there.

THINGS TO DO

1. From under the trees in the forest collect some soil with much humus in it. Look at it. Read again what is said about humus in sentences numbered 1 to 10 in this chapter.

2. First dry some humus soil, then pour water on it. You will see that the humus holds much of the water, sucking it up like a piece of cotton wool.

3. Look at some shells, coral, chalk or limestone.

4. Break some coral or limestone into small pieces. If you can heat these pieces for a long time over a *very* hot fire, they will probably turn into a coarse powder. This powder is quicklime.

5. Pour a few drops of water on this dry lime. The water will sink into the lime, which will swell and get hot. The lime and the water together make a new thing called slaked lime.

6. Pour water on shells, coral, chalk and limestone. They will not get bigger or become hot. Coral, limestone,

quicklime and slaked lime are all different things. Lime in the soil is changed by water to slaked lime. This again is changed by the gases[1] in the air and becomes chalk. Things which are in the soil very slowly change the chalk to lime again. These changes go on happening all the time where there is chalk or lime in the soil.

QUESTIONS

1. Write down all the new words in this lesson and learn them.
2. Name two things which make the texture of sandy or clay soils better.
3. How are dead plants changed into humus?
4. Where can you find much humus?
5. Write down three things you know about humus.
6. What is peat? Name one country in which there is much peat. For what do people use the peat?
7. How can lime be made from coral or limestone? How can you change this quicklime into slaked lime?
8. Lime helps the texture of the soil. In what other way does it make the soil better?

CHAPTER 19

WHAT KIND OF SOIL HAVE YOU?

IF there is much gravel in a soil it is called a gravel soil. A soil with much sand in it is called a sandy soil, and a soil with much clay in it a clay soil. If the amounts of sand and clay are about equal, the soil is called a loam. This is the best kind of soil. It is neither light and dry like a sandy soil, nor heavy and wet like a clay soil.

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[1] Gas: air is a mixture of gases; steam is water in the form of gas.

These are the names of some of the different kinds of soil:

Soil which is $\frac{3}{4}$ sand and $\frac{1}{4}$ clay is called sandy soil.
Soil which has more sand than clay is called sandy loam.
Soil which is $\frac{1}{2}$ sand and $\frac{1}{2}$ clay is called loam.
Soil which has more clay than sand is called clay loam.
Soil which is $\frac{1}{4}$ sand and $\frac{3}{4}$ clay is called clay soil.
Soil which is more than $\frac{1}{4}$ humus is called peat soil.

These soils often have some lime in them. The word "lime" is then added to the name and they are called lime sands, lime sandy loams, lime loams, lime clay loams or lime clays.

Again, the amount of humus is shown by the use of the words "poor," "good," or "rich." For example, we talk about a poor lime sandy loam, a good lime sandy loam or a rich lime sandy loam, and so on with other kinds of soil.

How to find out what kind of soil you have:

1. *To separate the gravel, sand and clay*

Measure half a pint of soil. If you have no pint measure, use a tin. A 1-pound meat tin holds about a pint. It does not matter how big the tin is, but it is not easy to work with much soil.

Put the soil in a deep tin or in a bucket. Pour water on it and stir well. Let it stand for a short time, and any gravel in it will soon sink to the bottom. Quickly pour off the dirty water into another tin or bucket, leaving the gravel in the first bucket. Wash the gravel several times with clean water, pouring off the water each time into the second bucket. Keep on washing the gravel until the water from it is quite clean. Take the gravel out of the first bucket and dry it in the sun.

Stir the water in the second bucket. Let it stand for a short time and the sand will sink to the botton. Pour off the dirty water which has the fine clay in it into the first bucket, leaving the sand in the second bucket. Wash the sand several times as you did the gravel, pouring the dirty water each time into the other bucket. Take out the sand and dry it in the sun.

Let the dirty water with the clay in it stand for several days. When the water on top of the clay has become clear, pour it off, leaving the clay in the bucket. Take out the clay and dry it in the sun.

Now look at the three things you have separated, gravel, sand and clay. Of which is there most? Look at the names of the different kinds of soils on pages 36 and 37, and see which name suits your soil best.

If you have scales for weighing things you can weigh the dry soil first, and then weigh the gravel, sand and clay after you have separated and dried them.

2. *To find the amount of humus in the soil*

Take the same amount of soil as you took before. Dry it and spread it thinly on a tin lid. Put the lid over a fire, and, when it is hot, stir the soil gently. The small pieces of humus will get hot and burn with little sparks. When you see no more sparks the humus will all be burnt. Many sparks show that the soil is rich in humus; few sparks show that it is poor in humus.

If you have scales, you can find the weight of humus in the amount of soil you have taken by weighing the soil before you put it on the lid, and by weighing it again after the humus has burnt and the soil has become cold once more.

3. *To find if there is lime in the soil*

To do this you need a weak acid[1] such as sulphuric acid or hydrochloric acid. When this is poured on soil, which you must put in a glass or a china basin, and the soil is stirred you may see it bubbling.[2] If the soil bubbles much then there is much lime in it.

Questions

1. Write down the new words in this lesson and learn them.

2. How much sand and clay are there in a loam?

3. How much humus, lime, sand, clay, gravel, is there in a poor lime sandy loam?

4. What would you call a soil that has in it (*a*) good humus and clay, and (*b*) sand and clay?

5. What would you call a soil that has in it much humus, no lime, $\frac{1}{4}$ sand and $\frac{3}{4}$ clay?

6. Name an acid with which you can test for lime in soil.

7. What kind of soil is there in your school garden?

These are words used in Part 3 of this book:

1. layer sub-soil top-soil rock rotting lime
2. peat gravel sand clay loam

8. Complete the following sentences by using in each a word from line 1:

(*a*) In the sides of a pit we can often see three . . .
(*b*) Under the top-soil there is the . . .
(*c*) In the top-soil of a garden there are pieces of . . . plants.
(*d*) . . . is not a plant food, but it helps to make plant foods.

9. Complete the following sentences by using in each a word or words from line 2 above:

(*a*) . . . soil has much humus in it. People dig . . . and burn it in their fires.
(*b*) . . . soil gets hot quickly, but . . . soil is a cold, wet soil.
(*c*) A soil that is half sand and half clay is called . . .

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[1] Acid: a substance with a sour, sharp taste. Acids dissolve other substances, and the two named above will eat through metals.

[2] Bubble: a ball of liquid with gas in it: to make bubbles.

Farming Series

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